

CLAIMS

1. An exercise arm assembly, comprising:
 - 2 a main arm having a first end for pivoting on a frame of an exercise machine for pivoting about a first pivot axis;
 - 4 a swing arm having a first end pivoted to the main arm for pivoting about a second pivot axis and a second end; and
 - 6 a handle pivoted to the second end of the swing arm for pivoting about a third pivot axis, each pivot axis being non-parallel to the other two pivot axes, and at least one pivot axis being non-perpendicular to the other two pivot axes.
2. The assembly as claimed in claim 1, wherein the main arm has a first
 - 2 angled bend defining a first portion extending from the first end to the bend and a second portion extending from the bend to the swing arm pivot axis, and the
 - 4 swing arm has a second angled bend defining a third portion extending from the swing arm pivot axis to the second bend and a fourth portion extending from the
 - 6 second bend.
3. The assembly as claimed in claim 2, wherein the swing arm has a third,
 - 2 inward bend adjacent the handle defining a fifth portion extending inwardly from the third bend to the handle.
4. The assembly as claimed in claim 1, wherein the swing arm has an
 - 2 inboard side and an outboard side, and the handle is pivoted at the inboard side of the swing arm.
5. The assembly as claimed in claim 1, including a pivot connection
 - 2 between the main arm and swing arm defining the second pivot axis, the pivot connection including a range limiting device for limiting the rotation of the swing
 - 4 arm about the second pivot axis to a predetermined angular range.

6. The assembly as claimed in claim 5, wherein the pivot connection
6 comprises a pivot sleeve on one of the arms, a pivot bracket on the other arm,
and a pivot pin extending through the bracket and sleeve to rotatably secure the
8 bracket to the sleeve.

7. The assembly as claimed in claim 6, wherein the main arm and
2 swing arm each have a central axis extending up to said pivot connection, and
said pivot sleeve is secured to said one arm at a non-perpendicular orientation
4 to the central axis of said one arm.

8. The assembly as claimed in claim 6, wherein the range limiting device
2 comprises a limiter member on the sleeve having a slot defining said angular
range, and a pin mounted on the bracket for engagement in the slot.

9. The assembly as claimed in claim 1, wherein the handle comprises a
2 pivot bracket having a pivot shaft rotatably secured to the swing arm for rotation
about said third pivot axis, and a grip rotatably mounted on the bracket for
4 rotation about a fourth axis perpendicular to the third pivot axis.

10. The assembly as claimed in claim 9, wherein the grip is offset from the
2 third pivot axis.

11. The assembly as claimed in claim 9, wherein the grip extends transverse
2 to the third pivot axis and is not offset from the handle pivot shaft.

12. The assembly as claimed in claim 9, further comprising a pivot sleeve
2 secured to the second end of the swing arm, said pivot shaft being rotatably
secured in said pivot sleeve, and said pivot sleeve being oriented at a non-
4 perpendicular angle to said swing arm.

13. An exercise arm apparatus, comprising:
2 a pair of exercise arm assemblies;
each arm assembly having a main arm, a swing arm, and a handle;
4 each main arm having a first end for pivoting on a frame of an exercise
machine for pivoting about a first pivot axis and a second end;
6 each swing arm having a first end pivoted to second end of the respective
main arm for pivoting about a second pivot axis and a second end;
8 each handle being pivoted to the second end of the respective swing arm
for pivoting about a third pivot axis, each pivot axis being non-parallel to the
10 other two pivot axes, and at least one pivot axis being non-perpendicular to the
other two pivot axes.

14. The apparatus as claimed in claim 13, including a pivot sleeve extending
2 between the first ends of the main arms, and a pivot shaft rotatably mounted in
the pivot sleeve for securing at a selected location on an exercise machine
4 frame.

15. The apparatus as claimed in claim 13, wherein the exercise arm
2 assemblies define a central axis of the exercise apparatus main and swing arms
of each arm assembly each have at least one bend separating the arm into two
4 relatively angled portions with the second pivot axis located between the two
bends.

16. The apparatus as claimed in claim 15, wherein the exercise arm
2 assemblies define a central axis of the exercise apparatus, each swing arm has
an inboard side facing said central axis and an outboard side, and the handle is
4 pivoted at the inboard side of the swing arm.

17. The apparatus as claimed in claim 13, wherein at least a first portion of
2 the main arm and the first pivot axis define a first plane perpendicular to the first

4 pivot axis, and the swing arm is pivoted to the main arm at a location askew
4 from the first plane.

2 18. The apparatus as claimed in claim 13 including a pivot connection in
2 each arm assembly between the main arm and swing arm defining the second
4 pivot axis, the pivot connection including a range limiting device for limiting the
4 swing of the swing arm about the second pivot axis to a predetermined angular
range between an inner position and an outer position.

2 19. The apparatus as claimed in claim 18, wherein the inner position
2 comprises a rest position.

2 20. The apparatus as claimed in claim 19, wherein the swing arms are angled
2 outwardly in said rest position.

2 21. The apparatus as claimed in claim 18, wherein the pivot connection
2 comprises a pivot sleeve on one of the arms, a pivot bracket on the other arm,
4 and a pivot pin extending through the bracket and sleeve to rotatably secure the
4 bracket to the sleeve.

2 22. The apparatus as claimed in claim 21, wherein the range limiting device
2 comprises a limiter member on the sleeve having a slot defining said angular
range, and a pin mounted on the bracket for engagement in the slot.

2 23. The apparatus as claimed in claim 13, wherein each handle comprises a
2 handle bracket having a pivot shaft rotatably secured to the swing arm for
rotation about said third pivot axis, and a grip rotatably mounted on the bracket
4 for rotation about a fourth axis perpendicular to the third pivot axis.

24. The apparatus as claimed in claim 23, wherein the grip is offset from the
2 third pivot axis.

25. The apparatus as claimed in claim 23, wherein the grip extends
2 transverse to the third pivot axis and is coplanar with said third pivot axis.

26. The apparatus as claimed in claim 23, wherein each grip has opposite
2 ends, each end of the grip having projecting annular guards for preventing
contact between the user's hands when holding the grips on each arm assembly.

27. The apparatus as claimed in claim 23, wherein each handle bracket is
2 generally c-shaped and has opposite, parallel arms, the grip having a
longitudinal axis and being rotatably mounted between the arms of the handle
4 bracket for rotation about said longitudinal axis.

28. The apparatus as claimed in claim 27, wherein each arm of the handle
2 bracket has an outwardly projecting bumper aligned with the axis of said grip.

29. The apparatus as claimed in claim 13, wherein each pivot axis is non-
2 perpendicular to the other two pivot axes.

30. An exercise machine, comprising:
2 a support frame having a base, an upright portion extending upwardly
from the base and having an upper end, and an upper support extending
4 transversely from the upper end of the upright portion;
a seat supported on the frame;
6 a pair of exercise arm assemblies pivotally secured to the frame to extend
on opposite sides of said seat;
8 each arm assembly having a main arm, a swing arm, and a handle;
each main arm having a first end pivoted to the frame for pivoting about
10 a first pivot axis and a second end;

each swing arm having a first end pivoted to second end of the respective
12 main arm for pivoting about a second pivot axis and a second end; and
each handle being pivoted to the respective swing arm for pivoting about
14 a third pivot axis, each pivot axis being non-parallel to the other two pivot axes,
and at least one pivot axis being non-perpendicular to the other two pivot axes.

31. The machine as claimed in claim 30, wherein each pivot axis is non-
2 perpendicular to the other two pivot axes.

32. The machine according to claim 30, wherein the first ends of the main
2 arms are secured together and pivoted to the frame by a single pivot connection.

33. The machine according to claim 30, wherein the main arms are pivoted
2 to the upper strut and the swing arms depend downwardly from the upper strut,
each swing arm being pivoted to the respective main arm at a location spaced
4 below the first end of the main arm.

34. The machine according to claim 33, wherein each main arm has a first
2 downward bend separating the main arm into a first portion extending from the
first end to the first bend and a second portion inclined downwardly from the first
4 portion, and the swing arm has a second bend separating the swing arm into a
first portion extending from the main arm to the second bend, and a second
6 portion directed inwardly from the second bend towards the other swing arm.

35. The machine according to claim 34, including a pivot connection in each
2 arm assembly between the main arm and swing arm defining the second pivot
axis, the pivot connection including a range limiting device for limiting the swing
4 of the swing arm about the second pivot axis to a predetermined angular range
between an inner, rest position and an outer position.

36. The machine as claimed in claim 35, wherein each handle comprises a
2 pivot bracket having a pivot shaft pivotally connected to said swing arm, and a
grip rotatably mounted in said pivot bracket for rotation about a fourth pivot axis
4 transverse to the third pivot axis.

37. The machine as claimed in claim 30, wherein each handle is located
2 inboard of the respective swing arm facing said seat.

38. The machine as claimed in claim 30, including a pivot connection
2 between each main arm and the frame defining a respective first pivot axis, said
pivot connection including a range of motion device having a series of spaced
4 holes extending along an arc, and each main arm having a connecting pin for
releasably connecting said main arm to said range of motion device at any one
6 of a series of selected orientations relative to said range of motion device.

39. The machine as claimed in claim 30, including a pivot connection in each
2 arm assembly, each pivot connection comprising a pivot bracket secured to the
end of one of the arms and having a pair of spaced end plates projecting over
4 the end of the other arm, and a pivot pin extending between the end plates along
said second pivot axis and rotatably linked to the end of the other arm.

40. The machine as claimed in claim 39, wherein the pivot connection
2 includes a range limiting device for limiting the swing of the swing arm about the
second pivot axis to a predetermined angular range, the range limiting device
4 being mounted between said end plates.

41. The machine as claimed in claim 40, wherein the pivot connection
2 includes a sleeve secured to the end of said other arm and rotatably engaged
over said pivot pin, the range limiting device comprising a first part projecting
4 from said sleeve in a direction transverse to said second pivot axis and having
a notch defining said predetermined angular range, and a second part extending

- 6 between said end plates and engaging transversely in said notch for travel along said notch as said swing arm rotates about said second pivot axis.